North Carolina Department of Transportation
Highway – Railroad Interconnection and Preemption Inspection Form
(Instructions)

Date of Inspection: _____ Recorded By: _____

Inspection Team Members: _____

_____

Signal Inventory No.: _____ DOT Crossing No.: _____

Railroad Co: _____ RR Representative: _____

Railroad Milepost: _____ RR Rep. Phone: (_____)_____

Division: _____ County: _____ City or Town: In / Near _____

Date of Last Inspection: _____

Intersection

Route Number: _____ Name: _____

at

Route Number: _____ Name: _____

The highway number (US, NC, SR) and name on the top line should be the road that crosses the tracks. The highway number and name listed on the bottom line should be the intersecting roadway at the preempted signalized intersection.

It is important to note that in doing these inspections, there are three primary objectives that you are to achieve:

- **Verify that the total railroad warning time is adequate to accommodate preemption time required by signal plans.**
- **Identify railroad preemption phasing and timing required for traffic signal.**
- **Verify operation and condition of both railroad and traffic signal control equipment.**
- **Verify safe operation of preemption sequence and ensure that vehicles are clear of crossing dynamic envelope as train approaches.**

General Information

1. **Using Signal Plans** – Make sure the location is the correct location by checking the following items:

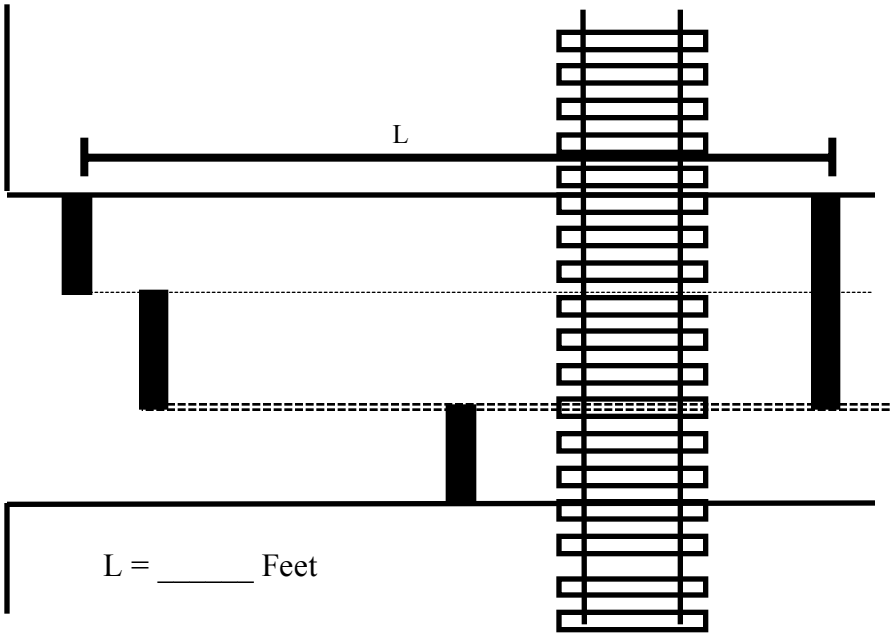
a. Signal inventory number shown on the signal plans is the same as shown on the signal cabinet.
b. All street names and route numbers in the field are the same as shown on the plans.
c. DOT Railroad Crossing Number, which should be posted on the Railroad equipment.
d. Name of Railroad Company operating on tracks at location.

2. Take **photos** (*if new installation or upgrade*) to show:
   a. All intersection and track approaches,
   b. Clear location of tracks as it relates to the intersection,
   c. Location of traffic signal cabinet and railroad cabinet/bungalow,
   d. Inside of traffic signal cabinet to show existing equipment,
   e. Inside of railroad signal cabinet/bungalow to show equipment,
   f. Span arrangement showing signal heads and signs,
   g. Pavement markings and locations of stopbars and crosswalks.

Geometric Inspection

3. Calculate track clearance green by current standard (Greenshield's formula).

Distance To Measure To Calculate Track Clearance Green Time (Greenshield's Formula)



If an approach has multiple stopbars, measure the distance from the stopbar behind the track to the farthest stopbar (closest to intersection).

Measure from stopbar behind track to stopbar at intersection. If calculation is less than 10 sec., use 10 sec. minimum.

a.) Calculation for Greenshield's Formula:
2 sec. x L/20 (L = distance divided by 20 feet per car)
+ 4 sec. (start-up delay)
_____ Seconds = Greenshield's Formula Green Time

b.) If Simultaneous Preemption is used, total amount of Track Clear Green required is Greenshield's Formula Green Time = [ ] Seconds

c.) If Advance Preemption is used, calculate Track Clear Green Time:

Amount of Advance Preemption = _____ (Min Green)
(Should be 6-8 Seconds) + _____ (Ped Clear)
+ _____ (Yellow Clear Before Preempt)
+ _____ (Red Clear Before Preempt)
Amount of Advance Preemption = [ ] Seconds
+ Greenshield's Formula Green (From 3a): _____
Total Amount of Track Clear Green Time = [ ] Seconds

You will need to enter the appropriate calculated Track Clearance Green time into the chart in Item 10 of this form.

d.) Is the calculated time above for the type of preemption used at this crossing (advance or simultaneous) consistent with what is shown on the signal plans and/or programmed in the field? **Yes** **No**

4. Compare actual intersection geometrics with what is shown on the signal design plans. (This check includes stopbar locations, signal head displays and configuration, signing, etc.) List any differences below: _____
_____
_____

Note any additional signing needs (example: "*DO NOT STOP ON TRACK*", "*LOW VEHICLE MAY DRAG", "ONCOMING TRAFFIC MAY HAVE [HAS] EXTENDED GREEN"* etc.). _____
_____
_____

This inspection looks at lane designs, traffic islands, pavement markings, grades, etc. Take note of the condition of railroad crossing surfaces, and the condition of the pavement itself along with pavement markings. Markings such as stop-bars and crosswalks need frequent maintenance. Remember stop bar locations are critical to the calculation of controller timings.

Signal head displays should match the signal plan. Signs should be in place as shown on the plans. The presence of a "DO NOT STOP ON TRACK" sign is recommended for installations where the potential exists for vehicles to queue up on the tracks.

Traffic Signal Operation Inspection

5. Intersection Operation: **Fully Actuated** **Semi-Actuated** **Pre-Timed**

6. Do vehicle and pedestrian heads (if present) appear to be L.E.D. and conform to the current design standards? **Yes** **No**

   NOTE: Countdown pedestrian heads should not be used at railroad preemption locations.

7. Are pedestrian signal heads programmed to clear concurrently with Yellow Clear Before Preempt? **N/A** **Yes** **No**

8. Are blankout signs Fiber Optic or L.E.D.? **N/A** **Yes** **No**

9. Note controller timing for preemption operation. Compare timing shown on the signal plans to times programmed into controller in field. Appendix A may be used to document the times if needed. If timing requires changing, cross out existing time and circle new time.

10. Calculate the total preemption warning time required based on the type of crossing warning system used at this location (Also Enter this Time in Item 34a):

If 4 Quadrant / Exit Gates are Present:

Function	Seconds
Equipment Reaction Time	4
Delay Time	
Min Green Before Preempt	
Ped Clear Before Preempt #	
Yellow Clear Before Preempt *	
Red Clear Before Preempt *	
Track Clearance Green	
Exit Gate Drop Time	11
Gates Horizontal Before Train	5
Total Warning Time Required	

If No Gates or 2 Quadrant Gates:

Function	Seconds
Equipment Reaction Time	4
Delay Time	
Min Green Before Preempt	
Ped Clear Before Preempt #	
Yellow Clear Before Preempt *	
Red Clear Before Preempt *	
Track Clearance Green	
Track Clearance Yellow	
Track Clearance Red	
Total Warning Time Required	

If Ped Clear Time is timed concurrently with Yellow Clear Before Preempt, enter only the exclusive amount of Ped Clear Time that is not displayed concurrently with the Yellow Clear.

For example, Ped Clear Time shown on the plan and programmed on the controller is 5 seconds and the Yellow Clear Before Preempt time is 4 seconds. Since 4 seconds of Ped Clear Time will be displayed during the Yellow Clear Before Preempt, only 1 additional second is needed for Ped Clear time (5-4=1). If more Yellow Time is displayed than Ped Clear time, use 0 for this calculation. (Typically this time should be 0-2 seconds.)

* For Yellow and Red Clear Before Preempt, use the times shown on plans and controller if Overlap P (**D) is used. If 0.0 is shown on the plans and programmed on the controller, use the yellow and red clearance times for the normal phase that has the highest total clear time required. If this phase is the Track Clearance Phase, use the times for the next highest phase.

** *Note: Overlap P is available on all 2070 controllers and some types of NEMA controllers. On some older NEMA controllers, Overlap D (or the last overlap available) is used instead.*

For most newer controllers, Overlap P can be programmed to overlap with all parent phases. The purpose of Overlap P is to help ensure a constant transition time into preemption. Since the railroad equipment is programmed to provide us with set number of seconds of warning and then activate with for another set amount of time, it is important that our signal transition time remain constant and not vary. With the use of advance preemption, it is important that we serve the (yellow and red) clearance time before preempt designed for and not transition to Track Clear Green too quickly. A quick transition and lead to termination of Track Clear Green before the gates are fully horizontal and possibly a vehicle getting trapped on the tracks or in the throat. Overlap P is an overlap that operates concurrently with all normal phases, but it also must terminate before the signal can serve the preemption clearance phases. On some older equipment where Overlap P is not available, Overlap D may used instead to serve the same purpose. Yellow and Red times for Overlap P (D) are determined as stated below.

To determine the Yellow Clear and Red Clear times Before Preempt, find the phase that has the* highest total *clear time (yellow + red). Do not use a higher yellow time from one phase and a higher red from another. For example, say Phase 1 requires 4.0 seconds of yellow and 2.5 seconds of red (6.5 total seconds), and Phase 2 requires 4.7 seconds of yellow and 1.5 seconds of red clearance (6.2 total seconds). For this calculation, use both the yellow and red times of Phase 1 since it requires the highest total clearance time. However, if Phase 1 is a phase used during the Track Clearance Phase and has the highest total time, use the highest total time of a phase that is not directly used for track clearance.

For Track Clearance Green, use the time calculated in Item 3 for the type of preemption used.

11. Is the phase/movements used during the Track Clearance phase also an exclusive phase/move during normal operation? (No, if normal phase also has an overlapping turning movement that does not operate during Track Clearance phase.) **Yes** **No**

If the Track Clearance Phase(s) are also a phase movement that can occur during normal operation, additional measures must to taken to ensure a safe transition to preemption. If this phase(s) is green, and there are no other clearances required before preempt can begin, the Track Clear Green may begin timing immediately, thus eliminating 6-8 seconds from your before preemption cycle. This is not good when trying to sync the signal phasing with the operation of railroad gates. If this is Yes, the 2 items below may be used to help provide consistent transition times.

Note that if the phase has an overlapping movement on another approach (right turn overlap), then this movement must clear before Track Clear Green can begin counting, so there will still be Yellow and Red Clear that must terminate before preempt can begin.

Are all parent phases used in normal operation programmed for Overlap "P" ("D") on the controller. **N/A** **Yes** **No**

See explanation above (Item 10) for use of Overlap P (D).

Is Track Clearance Phase programmed as an exclusive phase that does not operate during normal operation (ex, TC Phase = Phase 9)? **N/A** **Yes** **No**

Sometimes the Track Clearance Phase may be programmed as a unique phase (ie, 9), even though the movements in the phase are the exact same as the movements in a phase used in normal operation. For example, in a split side street pattern, phase 4 exclusively serves the movement across the tracks. This phase (movement) would also need to be served during Track Clearance. In this case, the TC Phase may be programmed as Phase 9. If the signal is in Phase 4 during normal operation when a preempt call is received, the controller will "transition" from Phase 4 to prepare to serve Phase 9. In this case, the Phase 4 Yellow and Red times are served in the controller, even though the yellow and red are not actually displayed in the field. (Since both phases display green, the signal will continue to display green during the transition, even while Phase 4 yellow and red times are served in the controller and Phase 4 is terminated.)

12. Observe operation of the signal, including control equipment in the cabinet and field equipment for proper operation. Is equipment operating properly and does the operation coincide with the signal plans? **Yes** **No**

    If No, identify any malfunctions or discrepancies observed. Include: bulbs out, signal heads in need of repair, pavement conditions, pavement markings, signage, etc. _____
    _____
    _____

    Make sure controller is timing intervals properly (the controller should display the active interval with it's timing counting down), some older controllers require a key to be depressed, or a switch to be toggled in order for the display to come up. Make sure detectors are picking up and dropping out vehicle calls (detectors may be programmed for extend and/or delay). Controller should be resetting the gap timer for each detector actuation received for the phase currently timing. En sure all signal head displays are visible.

13. If protective/permissive phasing is used and/or "yellow trap" backup protection is required for normal signal operation, ensure Phase Omits are used and NOT Red Revert. **N/A** **Pass** **Fail**

    Red revert should NOT be used at railroad preemption locations where protective/permissive phasing is used or where backup protection is required to avoid a "yellow trap." Phase Omits or some other form of backup protection should be used at preempted locations.

14. Activate the railroad preemption sequence from the cabinet and observe operation.

    Does sequence match the signal plans? **Yes** **No**
    Does preemption override minimum green times? **Yes** **No**
    If no, list reasons for nonconformance here: _____
    _____
    _____

    In the absence of a train, this can be done via the preempt test switch in the cabinet, or if a test switch is not present, request that the crossing signal maintainer activate preemption from the RR crossing control equipment case/bungalow. In the absence of a test switch, and the crossing maintainer is not immediately available, you may activate preemption by removing one of the interconnection conductors from it's terminal (WARNING-120VAC present on interconnect circuit). Preemption should be activated during the timing of a MINIMUM GREEN INTERVAL, controller should force out of minimum green to enter preemption. Observe controller and intersection signals during this test. Controller should run the TRACK CLEARANCE PHASE(S), and enter into the dwell phases. Some signals dwell in a single phase during preempt, others cycle several phases that are compatible with the train movement during preempt. Consult signal plan for preemption phasing. Keep preemption activated long enough for the signal to cycle through all of it's dwell (PREEMPT HOLD) phases (for a cycling preempt). For preempts that dwell in a single phase(s) (ex. Phases 2 and 6), the controller should remain in preempt long enough to time PREEMPT/DWELL MINIMUM GREEN and then go to rest. Also, observe the operation of the BLANK-OUT SIGNS. Make note of any signs that are out or not easily visible. When preemption call is released, controller should cycle to preemption exit phase(s), and blank-out signs should extinguish. Some blank-out signs extinguish as soon as the track call is released, some stay on through the yellow and red clearances out of preemption and extinguish when the preempt exit phase turns green. Consult signal plans for sign on-off sequencing.

15. If intersection has multiple preempts programmed, verify that Railroad Preempt is highest priority. **N/A** **Pass** **Fail**

    Some locations have multiple preemptions (ie, railroad and a form of emergency vehicle preemption). If multiple preemptions are activated simultaneously (or if one preempt is called while the controller is serving another preempt), railroad preemption shall be set for a higher priority to ensure that it is served when needed.

16. If crossing has multiple through line tracks, perform second train sequence test (preempt re-service). Does **preempt call release** immediately when gates **begin** to rise? **N/A Pass Fail**

Note: This is very important to the correct operation of preempt re-service.

Some crossings have two or more tracks that vehicular traffic must cross. When multiple tracks are present, the possibility exists that back to back preemption events can occur. This procedure checks to make sure the controller will retime the track clearance phase(s) should the preempt call be dropped by the first train (leaving the crossing), and then reapplied one or two seconds later by a second train (approaching the crossing). To perform this test activate the preemption, allow the controller to time a few seconds of the track clearance green interval, not exhausting the time. After these few seconds, remove the preempt call for one or two seconds and then reapply the call. The controller should immediately start to retime the track clearance phase(s) green interval at the beginning of the preset time. If the controller does not retime the track clearance phase(s), either special programming may need to be added to the controllers "write-protect" area, or the controller may not be appropriate to control a multi-track preemption location. In some special cases, a controller lacking second train sequence operation may be used in conjunction with special internally illuminated blank-out sign sequences. If a special blank-out sign sequence is needed, contact the NCDOT - Traffic Engineering and Safety Systems Branch for information.

Also, please note that the point in which the preempt call is released is very important to the proper operation of PREEMPT RE-SERVICE. When the possibility of second trains exists, the preempt call should be released as soon as the gates begin to rise, not when they reach the fully vertical position.

Traffic Signal Electrical Inspection

17. Signal equipment manufacturer (controller, cabinet and conflict monitor)

Type of Controller (Circle): **NEMA 170 2070 Other:** _____
Controller Manufacturer and Model**:** _____
Type of Cabinet (Circle): **TS-1 TS-2 170 Other:** _____
Cabinet Manufacturer and Model**:** _____
Conflict Monitor/MMU: _____

18. Cabinet Mounting (Circle): **Base Pedestal Pole**

19. Discuss location with Traffic Signal Technician Supervisor and note any issues or recent trouble calls at this location (maintenance problems, spares, etc.): _____
_____
_____

20. Check to make sure that phases used only during preemption are omitted during normal operation. **N/A Pass Fail**

There are phases that are often used exclusively during preemption (track clearance phase with a left arrow, a left turn during preemption dwell, etc.), that are not used in normal operation. It is very important that these phases are omitted during normal operation so that they are not served except during preemption. If these phases are not omitted, hidden clearances or left turn (yellow) trap situations may occur. The best way to test for this situation is to do the following: Identify the phases that are to be omitted. Look at the controller display. Is there a vehicle call present on the phase? If not, use the cabinet vehicle detector test switches to place a call on the phase, then watch to see if the controller serves the phase in sequence. If the phase is not served, then it is omitted from the sequence. If the phase is served, it is not omitted and the omit circuits and/or programming need to be added.

21. Check track interconnect circuit (relay for NEMA, AC isolator for 170 and 2070) for conformance to fail safe operation (normally energized). **Pass Fail**

The interconnection circuit is the communication link between the traffic signal equipment and the railroad crossing signal equipment. In order to interface the interconnection circuit with the traffic signal controller, one of two devices are commonly used. The track call relay is used in all NEMA traffic signal controller cabinets used in North Carolina. AC isolator cards are used for the same purpose in type 170 and 2070 cabinets. The normal operation state of the track call relay/ AC isolator card is very important to ensure that the preempt INTERCONNECT CIRCUIT is functioning properly. The INTERCONNECT CIRCUIT is normally a two-conductor cable running from the traffic signal cabinet to the crossing signal cabinet. The circuit shall be of the closed circuit principle, that is, the traffic signal controller (track relay/AC isolator) is normally energized and the circuit is wired through a closed contact of the energized control relay of the grade crossing warning system." When a train approaches, the control relay in the crossing signal cabinet de-energizes and breaks the interconnection circuit to the track call relay coil, or AC isolator, in the traffic signal cabinet, thus activating the preemption sequence.

This normally energized circuit arrangement is considered "FAIL-SAFE." In the railway-signal industry, a device is considered "FAIL-SAFE" if it fails in its most restrictive mode (i.e. in preemption). In the case of the interconnection circuit, if there is a break in either or both wires of the circuit, the traffic-signal controller unit would respond as if a train is approaching, clearing motor vehicles off the tracks, even though a train may indeed not be approaching. The signal will stay in the preemption mode until the circuit is repaired.

TO CHECK THE RELAY (IN NEMA CABINETS) for "FAIL-SAFE" wiring, make sure a train movement is not imminent or occurring, then identify the track call relay. Look at the contacts (most relays have a clear cover) and see if they are pulled in against the coil. If you cannot tell, try gently pulling the relay out of the socket, it you feel or hear the relay click, then it is normally energized and is FAIL-SAFE. If the relay does not click, it is not in conformance. If it is not practical to remove the relay from its socket, disconnect one of the interconnection conductors from its terminal (WARNING-120VAC present on interconnect circuit). If the signal goes to preemption when the wire is removed, it is FAIL-SAFE. If preemption does not activate, the circuit is not in conformance. Please note that to bring the circuit into conformance, the relay wiring has to be changed in both the railroad crossing signal cabinet and the traffic signal cabinet.

TO CHECK THE AC ISOLATOR CARD (IN TYPE 170 AND 2070 CABINETS) FOR "FAIL-SAFE" WIRING, make sure a train movement is not imminent or occurring, then identify the AC isolator card wired to the preempt interconnect circuit; it is installed in the input file. Identify the channel of the isolator card in which the interconnect circuit is wired. Remove one of the interconnect conductors (WARNING-120VAC present on interconnect circuit. When the conductor is removed, the associated led indicator should illuminate and the signal should enter preemption. If there is no response, the circuit is not in conformance. The AC isolator card, as with the relay, can be set-up to operate in either normally closed (FAIL-SAFE) or normally open situations. If the AC isolator card does not operate FAIL-SAFE, the card simply needs the necessary adjustments (i.e. internal DIP switch settings on the card) to make it operate normally closed (FAIL-SAFE). As with the track call relay, the wiring has to be changed in the RR signal cabinet, if indeed a change is necessary.

22. Perform the following tests while signal is in **flash mode**:

    a.) Check **blankout sign(s)** during flash (make sure controller switch is off during test). Blankout sign(s) should still illuminate for preemption during flash. **N/A Pass Fail**

    If for some reason the signal is transferred into the flash mode by the conflict monitor, the blank-out signs are still required to operate. To test this operation, follow this procedure: (1) Switch signal into flash during the main street green interval. (2) Switch power to controller to "OFF". (Be sure to keep flash activated and controller powered down until all of the following tests are executed). (3) Activate preemption by the preempt test switch, or by using other methods described earlier in this document. (4) Observe blank-out signs. If they are "ON," they meet this requirement. If they remain "OFF," they are not in conformance.

    b.) Check **flash color** of signals. Do flash colors match signal plans? **Yes No**

    While signal is in flash, CHECK FLASH COLOR of signal heads for each approach and compare to signal plan (note any non-conformances).

    c.) Check **start-up sequence**. **Pass Fail**

The start-up phase colors and intervals should always be displayed when exiting a flashing condition. In most cases, the start-up interval is the main street phase green interval, or the green of whatever phase(s) flash yellow. START-UP is supposed to automatically activate when exiting a flashing condition. Be sure that the correct START-UP or initialization phase(s) and interval are programmed correctly in the controller unit. To test this function, (1) power the controller up and make sure the flash switch on the inside of the cabinet door is in the "flash" position. (2) Check the controller display; the controller should be timing the minimum green interval of the initialization phase. (3) After the controller counts down for several seconds, toggle the flash switch to the "Auto" position. If the controller resets to the beginning of the minimum green in the initialization phase, START-UP is working properly. If controller continues to time without resetting, the operation is not in conformance.

23. Ensure that the controller is not programmed for late night flash. **Pass Fail**

Traffic signals utilizing railroad preemption should not be programmed for late night flash. They should only flash in the event of an equipment malfunction.

Railroad Crossing Signal Electrical Inspection

24. Identify the railroad signal warning equipment used (advance signal heads, flashers, cantilevers, 4 quadrant gates, etc.)_____
_____

Record all railroad-highway grade crossing warning equipment used at the crossing. This may include crossbucks, mast flashers, cantilevers with flashers, bells, (2 quadrant) gates, 4 quadrant gates, and advance traffic signal heads. Also note if railroad flashers are LED.

25. What is the condition of the interconnect circuit / contact in the railroad cabinet and/or junction box? _____
_____

Ask the Railroad Signal Maintainer to point out the preemption connection and check the condition of the wire and the terminals. At most locations, an intermediate connection may also exist in a nearby junction box. This is likely the place where the cable from the railroad bungalow is connected to the cable leading to the signal cabinet. This connection must be tight, free of corrosion, and in good condition.

26. Identify the general type of railroad signal equipment (motion detector, predictor, ac/dc, etc.)
_____

Look in the railroad signal cabinet (bungalow) and identify the type of controller used for the railroad warning equipment. The name of the controller should be printed on the front of the unit (Harmon PMD-3, Safetran GCP-3000-2, etc). Notify the Rail Division if the type of equipment has changed from the previous inspection.

27. Perform the following tests with a shunt placed across the rails in the island circuit or while a train is present:

    a.) Observe traffic signal **preemption operation**. **Pass Fail**

    Observe the traffic signal for proper preemption operation. The signal should remain in preemption long enough to run through the "track clearance" phase(s) and cycle through all dwell phases at least once.

    b.) Examine **RR flashers** and focus. **Adjusted Pass Fail**

While the crossing system is in active operation, examine the RR flashers and make sure all the lamps are working, and are focused to the approach for which they are intended.

c.) Examine **RR flash sequence** (all approaches should alternate together). *Note: Gate tip light burns solid.* **Adjusted Pass Fail**

Examine RR flasher flash sequence. All sets of RR flashers should alternate together for the same approach. This includes the lights on the gates (except for the tip gate light, which burns solid).

d.) Observe when preempt call to traffic signal is released. Preempt call should be released as soon as practical. **Pass Fail**

The preempt call should be released as soon as the crossing signal gates BEGIN to RISE (this is especially important if there are multiple through tracks). If no gates are present, the call should be released when the RR flashers are extinguished.

28. What is the general condition of the railroad-crossing surface?

Poor Fair Good Excellent New

Details: _____

Check the condition of the crossing surface. If it is POOR or FAIR, explain in the line above (loose or worn timbers, broken pavement, broken rubber, etc).

Type of Crossing Surface: _____

1) Section Timber
2) Full Wood Plank
3) Asphalt
4) Concrete Slab
5) Concrete Pavement
6) Rubber
7) Metal Sections
8) Other Metal
9) Unconsolidated
10) Other _____

Select the number of the material of the crossing surface from the list above.

Railroad Crossing Signal Track Circuit Inspection

29. Obtain the circuit length as shown on plan of record in the railroad signal cabinet. *(Measure from edge of travel lane/impact area)*

From Plans – Northbound/Eastbound approach: _____ Southbound/Westbound approach: _____

Measured in Field – Northbound/Eastbound approach: _____ Southbound/Westbound approach: _____

Each railroad cabinet (bungalow) should contain a set of plans for the highway-grade crossing warning signals. Record the approach lengths shown on the plans.

Using a wheel on the rail (not on the ground next to the rail), measure the distance from the edge of the crossing to the shunt/starter (beginning of approach circuit). This distance may vary from previous inspections or what is shown on the plans by ~25 feet +/- due to errors during measurement or exact starting and finishing points. Additionally, railroads may measure/record the approach circuit differently (from centerline of roadway, edge of roadway, or end of island circuit). Ask the maintainer where the measurement is determined from. We (NCDOT) want our distance measured from the edge of the crossing surface (potential impact point) to the shunt. Both directions/approaches of the crossing must be measured. Generally, the shunt distance will be the same for each track on a multi-track approach, so it is not necessary to measure each track on each approach, unless the multiple tracks represent separate lines/branches (not considered as 2 parallel or passing tracks). If the measured distance has noticeably changed from the previous inspection, please notify the Rail Division.

30. Check the condition of bonds (Head Bonds & Long Bonds) _____

Bonds will only be found at the rail joints on jointed track. In general, bonds will not be used on welded track. Head bonds are the short copper wires welded to the top or side of the rail. Long bonds have shafts that are driven into the sides of the rail, about midway between the top and bottom of the rail. Short and long bonds will be used only on track with no train wayside signals (Dark Territory). If the track has train wayside signals (Signalized Territory), there will only be short bonds installed. At a track switch, you could also find two (2) copper wires (Spring Bonds) side by side between the rails where the rails come together from each direction as well as long bonds.

31. Obtain maximum train speed for the crossing from railroad maintainer / inspector (*using Timetable Speed or Railroad Permanent Speed Restriction*).

Railroad Northbound / Eastbound approach: _____ MPH

Railroad Southbound / Westbound approach: _____MPH

(NOTE: City / Town ordinance does not apply – federal preemption of local or state laws, RR activities are interstate commerce)

Ask the Railroad maintainer for the train speed limit from as listed in the most recent timetable book. Use this speed or a permanent speed restriction set by the railroad. Some cities or towns may have a speed ordinance for the railroad, but the railroad is not required to obey it. Also, do not factor in "temporary slow order" conditions when determining speed. In some cases the speed limit may be higher on one approach than the other (due to yard limits, curve restriction, etc.). <u>If the train speed has changed from the previous inspection, please notify the Rail Division.</u>

32. Calculate amount of warning time provided by track circuitry: _____ Seconds

(<u>Shortest Approach Length)</u> (Minus) Equipment Reaction Time
(1.47) (Train Speed in MPH)

To calculate total warning time, multiply train speed (in MPH) by 1.47 (to convert MPH to feet/second), and then divide this speed into the distance for the shortest approach you measured. Then subtract the appropriate warning time for the RR equipment to obtain the programmed time:

Predictor (GCP 3000)	***4 Seconds***
Motion Detector (PMD 1&2)	***3 Seconds***
Motion Detector (PMD-3R)	***2 Seconds***
Harmon (HXP) (SCX)	***4 Seconds***
Audio Frequency Overlay (AFO)	***5 Seconds***
AC/DC	***0 Seconds***

33. Is crossing signal equipped with **advance preemption**? **Yes** **No**

Note: If advance preemption is utilized, an actual train movement **must** be observed.

Observed total warning time of actual train movement: _____ Seconds

Advance preemption is used at many crossings, especially at four quadrant gate installations. When advance preemption is used, the traffic signal preemption begins prior to the crossing signals being activated. When advance preemption is first activated, the motoring public may not yet be ware that a train is approaching. It is important to note that when ADVANCE PREEMPTION is used, it is possible for the time difference between initiation of preemption and activation of the crossing signals to be increased by a decelerating train approaching the crossing. It is imperative that the time difference does not increase to the point where the traffic signal track clearance green interval ends (i.e. traffic signal turns red) before the crossing signals activate.

In order to check ADVANCE PREEMPTION a train movement MUST be observed through the crossing. Note how much time expires from the time the preempt call is received and when the crossing signals activate. Observe if there is adequate time remaining in the track clearance green interval to clear vehicles off the track after the entrance gate is fully horizontal.

34. If Railroad crossing signal equipment is designed for constant warning time (i.e. predictor):

    a) How much warning time is programmed in the unit? _____ Seconds

    If the RR controller is a predictor, record how much warning time is programmed for the highway grade crossing warning devices. This should be the total amount of time preemption begins in advance of an approaching train. This time should provide a constant crossing warning time for every train, irregardless of speed. Note that a train accelerating/decelerating in the approach can vary the warning time displayed at the crossing.

    b) How much time does railroad program for flashers to flash before train arrival? _____ Seconds

    Railroads typically limit the amount of time their equipment will activate in advance of an approaching train. FRA regulations require at least 20 seconds of activation. For most preempted crossings, warning devices will normally activate 30-35 seconds before train arrival. This time can vary at each crossing and is based on individual railroad policy.

    c) If railroad provides advance preemption, how many seconds of advance warning time is programmed? _____ Seconds

    This is the amount of time between the time the railroad equipment detects an approaching train and the time the railroad flashers activate (first flash). This should usually be 6-8 seconds if used.

    NOTE: The total of b) and c) above should equal the total amount of warning time programmed in the predictor (a) if advance preempt is used (a = b+c OR a-b = c).

35. Compare preemption time required with RR advance warning time.

    a) Total Preemption Warning Time Required (from Item 10): _____ Seconds

    Enter total warning time calculated in Question 10.

    b) Total Warning Time Programmed on Railroad Predictor (if used) (from Item 34a): _____ Seconds

    Enter total warning time programmed on predictor from Question 33a. This time should be greater than or equal to the time shown in 34a.

    c) Total Warning Time Available from Track Circuitry (From Item 32):_____ Seconds

    Enter total warning time calculated from Question 32. This time should be greater than or equal to the times shown in both 35a and 35b.

    Track Circuitry Warning Time (c) should be greater than or equal to the Total Preemption Time Required (a) and the time programmed on the predictor (b) (if used). If (a) and/or (b) is greater than (c), immediate action must be taken (a <= b <= c).

Documentation

36. Mark-up a copy of the signal plan (if necessary). Show any field changes in red. The team leader should sign and date the changes on the plan and submit them to Traffic Engineering for an updated Plan of Record.

    You may need to mark-up a copy of the signal plan to clearly show actual stop-bar locations, or other field findings. Changes to signal design shall be reflected on marked up field copy and sent to Traffic Engineering.

37. Document any changes made in the field. (i.e. timing, etc.) _____
    _____
    _____
    _____

    If there are issues that were corrected in the field or still need to be addressed, list them in the space above. This should include anything related to pavement markings, signage, trees or brush that need trimming, and timing changes made to the preemption and/or warning time.

38. Are there any suggested signal / railroad revisions? (consider any geometric or environmental changes in the area.) _____
    _____

    If there are issues that were corrected in the field or still need to be addressed, list them in the space above. This should include anything related to pavement markings, signage, trees or brush that need trimming, and timing changes made to the preemption and/or warning time.

39. General comments: _____
    _____
    _____

    Add any other comments or useful information about this location here.

Send copy of this Inspection Form and any marked-up plans to:

	Traffic Signal Issues	Rail Crossing Issues
Mail:	NCDOT Traffic Engineering Branch Signals and ITS Unit Attn: Rob Ziemba, PE 1561 Mail Service Center Raleigh N.C. 27699-1561	Mr. Drew Thomas, PE NCDOT Rail Division Engineering and Safety Branch Capital Yard 1556 Mail Service Center Raleigh, N.C. 27699-1556
Office/ Delivery:	750 North Greenfield Parkway Garner, NC 27529 (919) 773-2800	Capital Yard 862 Capital Boulevard Raleigh, NC 27603 (919) 733-5564